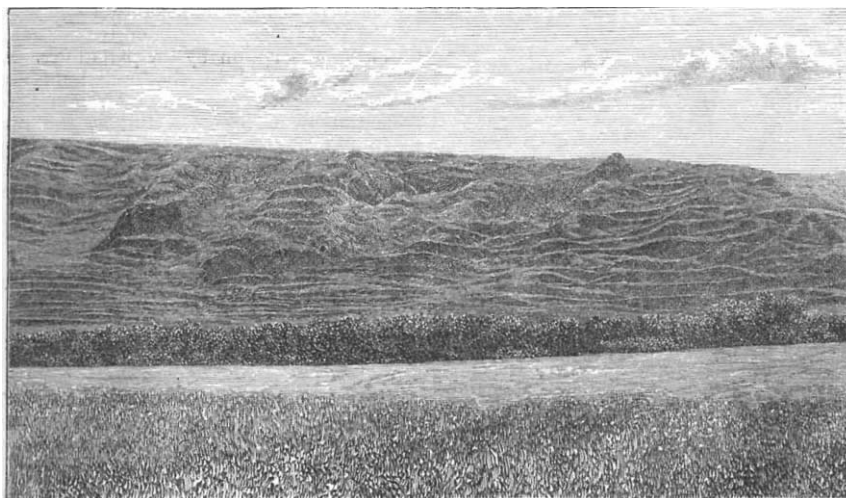


The Formation of Ledges on Hill-sides.

IN NATURE for February 28, Mr. Ernst draws attention to the formation of these ledges as observed by himself in Caracas. They are probably to be found in many places, if carefully looked for. The following diagram, taken from a photograph, illustrates one of the most striking instances I know, to be found near Ballantrae, on the Ballantrae-Girvan road, Ayrshire. The ledges, which are very numerous and fairly regular, occur on the western face of a series of low hills, very near to the sea-shore.



detrital mounds below the ledges at the foot of each slope. These, however, do not occur, and the soil meets the narrow strip of plain with surprising angular sharpness.

It seems clear that the ledges owe their origin to the action of rain-water, which would naturally penetrate below the surface covering of grass, and dissolve with comparative rapidity portions of the porous soil below. The grass layer would eventually have nothing to support it in places, and would collapse to a lower level. The effect of collapse, supposing the layer to hold together, would necessarily be a wrinkle or ledge at right angles to the ground slope.

EDMUND J. MILLS.

Glasgow, March 4.

Weight, Mass, and Force.

IF Mr. Gray, as in his teaching he no doubt unconsciously often does, will always say "force of a pound" instead of "weight of a pound" when he wishes to express the force of attraction of the Earth on a pound weight, there will be no divergence between his theoretical instruction and the language of practical men and of every-day life.

But to the majority the expression "weight of a pound" will always call up the mental picture of a "pound weight," so that the idea of the mass of a pound and of the force with which it is attracted by the earth cannot be dissociated in the use of the word "weight."

Supposing, however, we accept the definition of the "weight of a body" as never meaning anything else than the "force with which the earth attracts the body," how are we to interpret "the weight of the Sun, of the Moon, of Jupiter, &c.," and what is the "weight of the Earth?"

As Mr. Gray declines my previous challenge, will he condescend to point out the fallacy in the following argument? "The weight of the Moon being the force with which the Moon is attracted by the Earth, *ergo*, by the law that Action and Reaction are equal and opposite, the weight of the Earth is equal to the weight of the Moon."

With our present system of instruction in elementary theoretical dynamics we run the risk of wasting our time on a mechanics which is as unreal as is the mediæval Greek grammar taught in our schools, a grammar that was never vernacular even in the palmiest days of Attic literature.

The subsoil is thin and open. The angle of slope ranges from perhaps 30° to 60° , seldom higher. Where the angle is much higher, the soil slips away bodily, and the grass with it, leaving a bare space; indeed, at one point of the road the precipitated soil forms readily visible mounds at the base of the cliff.

The whole locality is very unfavourable to earthworms, and I agree with Mr. Ernst that the earthworm theory must, as far as any practical effect is concerned, be surrendered.

On the other hand, had the ridges been due to anything like glacier action, as Mr. Ernst suggests, I should have expected

The warning note in the introduction to "Numerical Examples in Practical Mechanics," by R. G. Blaine, is well timed and deserves careful attention.

A. G. GREENHILL.

The Inheritance of Acquired Characters.

A VERY strong *a priori* objection to the line on which most experiments on the inheritance of acquired characters are carried on is the following. These experiments involve mutilation; and a tendency to transmit characters so produced would, considering that every accident or fight produces some slight mutilation, involve the animals in a process of degeneration. Hence the tendency to transmit the characters acquired *by mutilation* would be constantly bred out by natural selection. But a tendency to transmit characters acquired *by habit* in youth rests on quite another basis, and would tend to the conservation of the race.

I do not know if observations have been made on the physique of the offspring of persons engaged in trades where apprenticeship begins before puberty: they would be most valuable.

But the following case seems to me to be thoroughly to the point. A. B. is moderately myopic and very astigmatic in the left eye; extremely myopic in the right. As the left eye gave such bad images for near objects, he was compelled in childhood to mask it, and acquired the habit of leaning his head on his left arm for writing, so as to blind that eye; or of resting the left temple and eye on the hand, with the elbow on the table. At the age of fifteen the eyes were equalized by the use of suitable spectacles, and he soon lost the habit completely and permanently. He is now the father of two children—a boy and a girl—whose vision (tested repeatedly and fully) is emmetropic in both eyes, so that they have not inherited the *congenital* optical defect of their father. All the same, they both have inherited his early acquired habit, and need constant watchfulness to prevent their hiding the left eye, when writing, by resting the head on the left fore-arm or hand. Imitation is here quite out of the question.

Considering that every habit involves changes in the proportional development of the muscular and osseous systems; and hence, probably, of the nervous system also, the importance of inherited habits, natural or acquired, cannot be

overlooked in the general theory of inheritance. I am fully aware that I shall be accused of flat Lamarckism; but a nickname is not an argument.

MARCUS M. HARTOG.

Cork, March 6.

A Fine Meteor.

A FINE meteor was visible here to-night at 6.36 p.m. It fell perpendicularly almost due north-north-east, disappearing about 20° above the horizon, and was then as nearly as possible of the brilliancy and colour of Venus, which was shining in the south-west at the time. Length of path, I think, about 20°, but I am not positive that I saw the beginning of it.

B. WOODD SMITH.

Hampstead Heath, N.W., March 11.

Bishop's Ring.

I AM informed by Miss E. Brown, of Cirencester, that she saw Bishop's ring in full day-time as recently as last month, not far from 12 o'clock one day, the sun being hidden behind a cloud at the time. It appeared very similar in extent, as well as colour, though not intensity, to what it did after the Krakatoa eruption. Also another day she noticed something like it when looking at the sun simply through a dark glass.

I have very occasionally myself in the last few years seen a somewhat similar phenomenon, but duller and dirtier in colour than Bishop's ring usually was, and which gave me the impression of being lower down in the atmosphere than that. I attributed this to smoke or some other local impurity. It would appear that the phenomenon seen by Miss Brown, out in the country, cannot have been thus caused; but I suppose that she must really have seen the corona produced by volcanic dust, through an exceptionally pure lower atmosphere.

Sunderland, March.

T. W. BACKHOUSE.

The Philosophical Transactions.

MOST people who interest themselves in science would be glad to possess a complete set of the Philosophical Transactions. But in the first place complete sets are scarce, and in the second it would be much too expensive for ordinary people; furthermore, it is not in everyone's library that room could be found for its reception. Now, Drs. Hutton, Shaw, and Pears have brought out a first-rate abridgment of this valuable publication from its commencement to the end of the year 1800. May I venture to suggest that the Royal Society would be doing a good work by publishing on the same lines a continuation up to the year 1900? If they commenced now, and brought out a volume at intervals, the whole thing might be completed in the early years of the twentieth century. The cost ought not to be very great, and probably nearly every free library would subscribe.

S.

ON THE COMPOSITION OF WATER.¹

DURING the past year I have continued the work described in a former communication on the relative densities of hydrogen and oxygen (Roy. Soc. Proc., February 1888, vol. xlii. p. 356; see also NATURE, vol. xxxvii. p. 418), in the hope of being able to prepare lighter hydrogen than was then found possible. To this end, various modifications have been made in the generating apparatus. Hydrogen has been prepared from potash, in place of acid. In one set of experiments the gas was liberated by aluminium. In this case the generator consisted of a large closed tube sealed to the remainder of the apparatus; and the aluminium was attached to an iron armature so arranged that, by means of an external electro-magnet, it was possible to lower it into the potash, or to remove it therefrom. The liberated gas passed through tubes containing liquid potash,² corrosive sublimate, finely powdered solid potash, and, lastly, a long length of phosphoric anhydride. But the result was disappointing, for the hydrogen proved to

be no lighter than that formerly obtained from sulphuric acid.

I have also tried to purify hydrogen yet further by absorption in palladium. In his recent important memoir (*Amer. Chem. Journ.*, vol. x. No. 4), "On the Combustion of Weighed Quantities of Hydrogen and the Atomic Weight of Oxygen," Mr. Keiser describes experiments from which it appears that palladium will not occlude nitrogen—a very probable impurity in even the most carefully prepared gas. My palladium was placed in a tube sealed, as a lateral attachment, to the middle of that containing the phosphoric anhydride; so that the hydrogen was submitted in a thorough manner to this reagent, both before and after absorption by the palladium. Any impurity that might be rejected by the palladium was washed out of the tube by a current of hydrogen before the gas was collected for weighing. But as the result of even this treatment I have no improvement to report, the density of the gas being almost exactly as before.

Hitherto the observations have related merely to the densities of hydrogen and oxygen, giving the ratio 15'884, as formerly explained. To infer the composition of water by weight, this number had to be combined with that found by Mr. Scott as representing the ratio of volumes. The result was—

$$\frac{2 \times 15'884}{1'9965} = 15'914$$

The experiments now to be described are an attempt at an entirely independent determination of the relative weights by actual combustion of weighed quantities of the two gases. It will be remembered that in Dumas's investigation the composition of water is inferred from the weights of the oxygen and of the water, the hydrogen being unweighed. In order to avoid the very unfavourable conditions of this method, recent workers have made it a point to weigh the hydrogen, whether in the gaseous state, as in the experiments of Prof. Cooke and my own, or occluded in palladium, as in Mr. Keiser's practice. So long as the hydrogen is weighed, it is not very material whether the second weighing relate to the water or to the oxygen. The former is the case in the work of Cooke and Keiser, the latter in the preliminary experiments now to be reported.

Nothing could be simpler in principle than the method adopted. Globes of the same size as those employed for the density determinations are filled to atmospheric pressure with the two gases, and are then carefully weighed. By means of Sprengel pumps the gases are exhausted into a mixing chamber, sealed below with mercury, and thence by means of a third Sprengel are conducted into a eudiometer, also sealed below with mercury, where they are fired by electric sparks in the usual way. After sufficient quantities of the gases have been withdrawn, the taps of the globes are turned, the leading tubes and mixing chamber are cleared of all remaining gas, and, after a final explosion in the eudiometer, the nature and amount of the residual gas are determined. The quantities taken from the globes can be found from the weights before and after operations. From the quantity of that gas which proved to be in excess, the calculated weight of the residue is subtracted. This gives the weight of the two gases which actually took part in the combustion.

In practice, the operation is more difficult than might be supposed from the above description. The efficient capacity of the eudiometer being necessarily somewhat limited, the gases must be fed in throughout in very nearly the equivalent proportions; otherwise there would soon be such an accumulation of residue that no further progress could be made. For this reason nothing could be done until the intermediate mixing chamber was provided. In starting a combustion, this vessel, originally full of mercury, was charged with

¹ A Paper read at the Royal Society, by Lord Rayleigh, Sec.R.S., on March 7.

² Of course, this tube was superfluous in the present case, but it was more convenient to retain it.